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SCIENCE REVIEW OF THE NET ENVIRONMENTAL BENEFITS ANALYSIS OF DISPERSANT USE FOR RESPONDING TO OIL SPILLS FROM OIL AND GAS FACILITIES ON THE NEWFOUNDLAND GRAND BANKS

Context

In December 2013, the Canadian Association of Petroleum Producers (CAPP) submitted the report, entitled "Net Environmental Benefit Analysis of Dispersant Use for Responding to Oil Spills from Oil and Gas Facilities on the Newfoundland Grand Banks" to the Canada-Newfoundland and Labrador Offshore Petroleum Board (C-NLOPB). On February 7, 2014, the Fisheries Protection Program of the Ecosystems Management Branch in the Newfoundland and Labrador Region requested that DFO Science undertake a review of this document.

A DFO Science Response Process (SRP) was undertaken with the objective to review and provide comment on the document regarding the suitability of using dispersants in responding to spills of crude oil from production and drilling installations on the Newfoundland Grand Banks.

Science expertise within the Newfoundland and Labrador Region was solicited and participants provided a review of the report which was collated before a draft of the prepared response underwent a group evaluation for consensus on the final Science Response. It should be noted that DFO Science Branch comments were limited to the areas of the report where expertise was available at the time of the review, including that from Ecological Sciences, Groundfish, Shellfish, and Marine Fish Species at Risk Sections.

This Science Response Report results from the Science Response Process of 15 April 2014 on the Review of the Net Environmental Benefits Analysis of Dispersant Use for Responding to Oil Spills from Oil and Gas Facilities on the Newfoundland Grand Banks.

Background

Dispersants have been accepted as a marine spill response tool in numerous jurisdictions for many years. As early as the late 1960s, Canada was already assessing the issues surrounding dispersant use and in 1972, Environment Canada's Environmental Emergencies Branch (EEB) was established with the responsibility of testing oil spill dispersants and developing spill countermeasures for regions of Canada that have both a significant risk of spills and a high environmental sensitivity to spills.

In 1973, EEB adopted "Guidelines on the Use and Acceptability of Oil Spill Dispersants". These guidelines were driven by the need for effective spill countermeasures to support petroleum exploration in remote and harsh environments on Canada's East Coast and in the Arctic.

In recent years, however, there has been some dispute regarding the regulation of dispersants in Canada, largely as a result of legislation that appears to conflict with dispersant use. In particular, Section 36 of the *Fisheries Act*, which prohibits the deposit of any deleterious substance into the Canadian marine environment, has been interpreted by some regulators to prohibit dispersant use.

This report analysed the suitability of using dispersants in responding to spills of crude oil from production and drilling installations on the Newfoundland Grand Banks. Suitability of dispersants

was assessed based on the five criteria used in dispersant use guidelines in many jurisdictions around the world:

- Dispersibility of Hibernia, Terra Nova and White Rose crude oils (Grand Banks crude oils) when fresh, and estimated Time Window for dispersant response;
- Potential Net Environmental Benefits of using dispersants on spills near existing production and drilling installations;
- Logistical capabilities for offshore response on the Grand Banks;
- Suitability of local weather and ocean conditions for dispersant operations; and
- Status of regulatory controls.

The Net Environmental Benefits (NEB) assessment used oil fate and trajectory models to estimate the movement, spreading and dissipation of spilled crude oil on the Grand Banks and the extent of exposures of Grand Banks populations and fisheries to crude oil slicks and chemically dispersed crude oil.

Species of marine mammals and turtles, finfish and shellfish were considered in the assessment, as well as the (five) most important commercial fisheries in Unit Areas near the Grand Banks drilling and production facilities.

Analysis and Response

General Comments

Regulatory conditions for use of oil spill dispersants in Canada remain unsettled. An inability to use dispersants has been recognized as a gap in oil spill response plans developed for offshore Newfoundland and Labrador even though dispersant use is commonly permitted in other countries. The Turner Report in 2010 and a Report of the Commissioner of the Environment and Sustainable Development in 2012, both recommend the use of dispersants as an effective oil spill counter measure.

Furthermore, as noted in the present report, legislative amendments introduced in the House of Commons in February 2014 will provide the Offshore Petroleum Boards in NL and NS with authority to approve dispersants use in consultation with the federal Ministers of Environment and Natural Resources, if there is a net environmental benefit.

The remit of the present Review was to carry out an assessment on whether use of dispersants in Offsho e Newfoundland and Labrador could provide a net environmental benefit. The Review included ; nalysis of: (a) oil fate and trajectory models (b) toxicity/effect data (c) populations of various m; rine species including commercial fisheries species and (d) oil vulnerability data for populations of valued ecosystem components (VECs). The assessment was based on (a) a batch spill of $20m^3$ (b) a batch spill of 300 m^3 (c) a blowout (6435 m^3) for 30 days and (d) a subsea blowout (6435 m^3) for 30 days.

The Report conclusion that use of dispersants on the Grand Banks will provide a net environmental benefit comes with analysis of a large data base produced over a number of years. Furthermore, use of dispersants can be a net benefit for the fishing industry through decreasing potential problems related to gear fouling and the presence of oil slicks, which can elicit perceptual concerns about tainting and resource marketability, leading to fishery closures. There are case histories of this.

While the conclusions derived from the simulated data are credible and realistic, the inferences and conclusions regarding the Net Environmental Benefits to the local fauna/populations are not as compelling. The reasons for the latter include:

- The authors considered only a handful of fish species in their analyses, disregarding species such as Capelin, arguably the most important foraging pelagic fish of the Grand Bank marine ecosystem, and Northern and Spotted Wolffish, both listed as threatened under SARA and COSEWIC, and occurring in the study area;
- In several occasions the authors argued that the impact of oils spills (and the use of dispersant) on fish mortality would be minimum because only a small fraction of the population/particular life stage occurs in the study area. However, it is unclear how the authors arrived to such conclusions without considering the most recent data available on fish distribution and abundance;
- The main argument of the study is that the dispersant will break down oil molecules and facilitate biodegradation, however, it does not address the removal of oil from the water and associated mortality of marine organisms exposed to it.
- Comparative analyses are not considered in this study. Are there other examples of NEBA? E.g. Gulf of Mexico and Deepwater Horizon?

As a result, this study provides a more qualitative analysis of the effects of dispersants on oil spills and associated environmental benefits. Nonetheless this study clearly improved the knowledge about (i) crude oil movements and fate resulting from local oceanographic and weather regimes, and (ii) the logistical capabilities and requirements needed for offshore response on the Grand Bank in the case of oil spills. A further extension of this work is required to quantitatively assess the environmental benefits of using dispersants on oil spills and would include data on the distribution and abundance of additional important species occurring in the study area which are often available through DFO publications and databases.

Regarding any new regulatory regime, given the short time frame (a matter of hours) for dispersant effectiveness, regulatory pre-approval would seemingly be required e.g. "no time" for extensive consultation. This might be the case for batch spills whereas a blowout would likely require considerable consultation for a variety of reasons to assess if dispersants might provide a net environmental benefit.

Specific Comments

Executive Summary

"The report also discussed several questions raised regarding dispersant use during the recent Deepwater Horizon oil spill in the Gulf of Mexico (United States, 2010)". Given the level of detail presented within the other sections of the **Executive Summary**, a synopsis of the "questions raised" with respect to the use of dispersants for the Deepwater Horizon Spill should be presented here.

"Third, most of these fishery species are relatively long lived with average life spans of ten years or longer. As a result, even if a portion of the young of the year (YOY) age class is impacted, the age-class represents only 10% or less of the total population, so the impact on the population as a whole is small." And page 103, Bullet 2. *"Dispersant use increases the exposure of segments of fin- and shellfish populations to oil, but the segments of these populations actually exposed are small and as a result the overall impact to the fish and shellfish*

populations from dispersant use is correspondingly small." Although a species may live for 10+ years, reproductive recruitment or strong year classes may be sporadic in nature (e.g. 2002 relatively strong year class of northern cod). It should also be noted that a number offshore species such as cod are currently at historic low levels with respect to spawning stock biomass (SSB). If a spill scenario occurred during a significant recruitment year the overall impacts on fish populations while still perhaps not catastrophic may be more than the text indicates and should be discussed from this perspective.

3.5.2 Finfish and Shellfish Algorithm

What is the rationale for selecting only Atlantic Wolffish? Northern Wolffish and Spotted Wolffish are considered Threatened under the Species at Risk Act, while Atlantic Wolffish is only a Species of Concern.

The Resource Impact Algorithm tends to minimize effects of dispersants by assuming: a) that larvae are distributed throughout the entire water column throughout the larval period. This is not true, with larvae being initially within the surface layer (upper 30 m, including the upper 10 m); b) that larvae are horizontally distributed throughout the entire area of adult distribution. This too is not true with larvae likely limited to areas where settlement subsequently occurs, in shallow inshore areas and on banks; and c) that young of the year comprises about 7% of the population, based on a life span of 15 years. This assumption of equal numbers of all age classes in the population defies all natural mortality concepts. Most of the population in number at any time is represented by the current year class. This applies to northern shrimp as well.

3.5.3 Commercial Fishery Algorithm

The analysis is restricted to fishery landings made within Canada. However, many of the species are trans-boundary (extend beyond Canadian EEZ) and any spills within the Canadian EEZ could impact non-Canadian fisheries occurring adjacent to Canadian waters. (Based on information provided, impact on bottom-dwelling groundfish likely to be minimal.) This impact should be acknowledged and discussed.

3.5.6 Exposures and Effects of Chemically Dispersed Oil

"The key question is what exposure conditions are sufficient to cause damage to aquatic species? This determines whether initial exposure concentrations are sufficient to cause damage and to what extent must the cloud dilute before oil concentrations fall below the toxic threshold." The authors have not answered their own question. What do the available literature/studies conclude in similar circumstances?

"Most recently Hemmer et al., (2011) showed that in toxicity tests with eight of the dispersant products on the US National Contingency Plan Product Schedule, the toxicity of an oil dispersant mixture with South Louisiana crude oil, the toxicity of oil dispersant mixtures was similar to that of the dispersions of the oil alone.

This conclusion is as important now as it was when it was first discovered in the early 1980s, because it means that when modeling the toxicity of chemically dispersed oil, only the toxicity of the dispersed oil is important, the toxicity of the dispersant can be ignored." How do these findings relate to other research indicating there may be a synergistic toxicological relationship of oil/ Corexit 9500 that is up to 52-fold the toxicity of either component individually (Martinez et al 2013).

5.2.3 Chemically Dispersed Case

"It has been assumed that slicks from the installation blowout would be treated with dispersants immediately as they form. Slicklets would be fully treated and dispersed within a few kilometers of the spill site. All of the oil on the surface would be dispersed to form a 10 m deep dispersed oil cloud equal in size to the slick at the time of spraying." Is this really a solution? Wildlife will be impacted regardless.

7.2.2 Environmental Impact and Net Environmental Benefit

There is discussion (this section and elsewhere) of impact to Atlantic cod fisheries within this area. However, directed fishing is closed in this area and all cod catches are by-catch taken in fisheries for other species.

"The wolffish population is similarly unaffected by the oil slick and potentially might suffer only a small impact from the blowout plume." What about Spotted Wolffish and Northern Wolffish populations? Also, as there is little information regarding early life-stages of wolffish in the area, how did the authors conclude that these early stages do not occur in the upper water layer?

7.3.2 Environmental Impact and Net Environmental Benefit

"Dispersing the oil poses no risk to YOY Greenland halibut and wolffish because planktonic life stages of these species do not typically occur in the upper water column where toxic concentrations might occur." As there is little information regarding early life-stages of wolfish, how did the authors conclude that these early stages do not occur in the upper water layer?

7.5 Summary

"These planktonic life stages correspond to less than 10% of the population of most species. In addition, in most species planktonic life stages are present only for a few months out of the year; for the remainder of the year even this year class is relatively invulnerable to oil." Please provide the references to support these statements.

8.0 Vulnerability Profiles

Populations of cod in NAFO Divs. 2J3KL and Divs. 3NO are distinct and should be presented separately within Table 8.1.

9.0 Summary and Conclusions

"The analyses showed that using dispersants would offer a clear net environmental benefit if a spill were to occur. Specifically, untreated spills in this location pose a significant risk to important marine bird populations and commercial fisheries. These risks can be greatly reduced by using dispersants. Untreated spills pose little risk to local finfish -and shellfish populations. Dispersant use may increase the oil exposure of portions of finfish- and shellfish populations, but the proportions of these populations actually exposed would be small. As a result the overall impact to the fish and shellfish populations from dispersant use is correspondingly very small." The report did not provide enough evidence to support the final statement.

A2.4 Shellfish, Finfish and Fisheries

"Assuming a mean life expectancy in the population of 20 years, the YOY year age class makes up approximately 5% of the population." This statement incorrectly assumes equal numbers of fish at each age in the population. In reality, there are vastly greater numbers of juveniles in the population, with relatively few surviving to mature ages. The percent number of individuals

would be substantially higher than 5%. Similar statements are made about other species and should be reviewed.

A2.4.1 Snow Crab

In the list of the three centres of the crab fishery, Cape Breton should be replaced with Eastern Scotian Shelf.

"Puebla et al., (2008) suggested that there is a degree of genetic/reproductive isolation among stocks and hence reproductive isolation. For the purposes of this report, we assume that the Grand Banks stock is a reproductively isolated stock..." This study concluded that there is no genetic differentiation, with the entire Northwest Atlantic snow crab resource representing a single panmictic population. Consequently, the assumption is invalid and the opening statement regarding reproductively-isolated stocks is also untrue.

The highest abundance typically in the 70 to 400 m (not 280 m) depth range.

The mating migrations are not inshore-offshore migrations.

Females carry the fertilized eggs on their pleopods (under the abdomen) for either one or two years (not up to two years).

Eggs hatch in the spring (April to June), yielding planktonic larvae that move upward to surface waters (upper 30 m) and remain in the water column for three to five months.

"There is little information available on the vertical distribution of snow crab larvae in the water column or on their horizontal distribution." This statement is not true as larvae are initially in the upper 30 m surface layer after hatching and become distributed in the upper 0-150 m by settlement in the fall.

The assumptions that YOY are uniformly distributed vertically in the water column and are uniformly distributed horizontally in the waters of the area of adult distribution are invalid. Snow crabs migrate from shallow settlement areas to warmer deeper areas where larger males are most common.

"*The average longevity is approximately 15 years, with the planktonic YOY year class making up approximately 7% of the population."* While no estimates are available, larval and early benthic mortality is tremendously high so the current year class represents most of the population.

Virtually all of the catch is taken in the spring and summer months (April to July).

A2.4.2 Northern Shrimp

In the Northwest Atlantic, northern shrimp occurs on the shelf and slope from Davis Strait to the Gulf of Maine and from eastern Newfoundland and Labrador to the Gulf of St. Lawrence.

"The planktonic YOY class represents about 20% of the population." See previous relevant comment on snow crab; ie YOY would represent more than 20% of the population.

The table of seasonality of life history events (Table A2-23) does not seem logical. Also, the source for northern shrimp information was only an underwater world factsheet; more reliable information such as an assessment document should have been consulted.

A2.4.4 Greenland Halibut

The management unit is subarea 2 + Divs. 3KLMNO. A TAC is set for the entire management unit, with NAFO managing the 3LNO portion of the fishery & Canada manages the remainder.

A2.4.6 Atlantic Wolffish

The depth range for this species is much deeper than 150m. What reference/ source of information was used? There is no directed fishery for Atlantic wolffish on the Grand Banks, but they are commonly captured in other fisheries. Also, why are commercial catches not mapped for this species as was done for other species of fish?

Conclusions

The Report conclusion that use of dispersants on the Grand Banks will provide a net environmental benefit comes with analysis of a large data base produced over a number of years. While the conclusions derived from the simulated data are credible and realistic, the inferences and conclusions regarding the Net Environmental Benefits to the local fauna/populations are not as compelling. A further extension of this work is required to quantitatively assess the environmental benefits of using dispersants on oil spills and would include data on the distribution and abundance of additional important species occurring in the study area which are often available through DFO publications and databases.

The document would benefit from the review of more recent literature. Also, more reliable information sources such as species assessment documents should have been consulted rather than DFO fact sheets.

Many of the assumptions within the document have been challenged as invalid or untrue and should be revisited, corrected and re-analyzed to determine if they impact on the conclusions regarding the net environmental benefits of dispersant use.

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